

Lifestyles of the Scaled and Beautiful: Pearl and Northern Crescents

by Ernest H. Williams

Which are the commonest butterflies in North America?

You might think Monarchs, but my guess is that the answer is actually Pearl Crescents, which are among the most widespread and best known butterflies throughout most of

the United States. To show you how common they are, Pearl Crescents were seen on 295 of the 442 Fourth of July counts in 2006. Only Monarchs and Cabbage Whites were seen in





*Above: Pearl Crescents throng a butterfly milkweed.
July 23, 1993. Chappaqua, Westchester Co., NY.*

*Opposite page: A Pearl Crescent adds color to an ox-eye daisy.
July 5, 2006. Lexington, Greene Co., NY.*

more count circles that year. If you add the 55 counts reporting Northern Crescents but not Pearl Crescents, then the 350 counts on which either were seen tops all species.

The record high number of Pearl Crescents seen on a single count is 3352, a number that shows how abundant they can be. I'm always happy to find one of these little butterflies and think of them as friends. Because of the close relationship between Pearl and Northern Crescents and confusion between them (discussed later), I'd like to consider both of these taxa in this article.

The English name Pearl Crescent tells you something right away about them. At the underside edge of their hindwings, standing out against a patterned background, lies a brown blotch with a light-colored crescent in the middle. The crescent sometimes appears

pearly in color. Why they have a crescent is one of those difficult questions in nature to answer, but a similar pattern is found in all closely related species.

Pearl Crescents are small butterflies with weak flight, usually skimming within a couple of feet of the top of the vegetation. One sees Pearl Crescents more easily by looking down, not up, and you can learn to distinguish the two sexes on the wing. Males fly a lot, fluttering from here to there, and they are small butterflies with a conspicuously open orange area in both their upper hind and forewings that contrasts with the dark outer margins. Females are a little larger than males, and they display a bolder pattern of lines through the orange patches. The orange may appear two-toned; also, they're less active and settle down in the vegetation for longer



Pearl and Northern Crescents lay masses of eggs. Oct 3, 2002. Somerset Co., NJ.

periods of time. With a good look, you'll also see that females have a bolder, darker pattern of lines on their hindwings below.

These butterflies live in open fields, both natural and disturbed, and their needs are not highly specialized. Their extensive distribution comes from their use of common plants, asters, as caterpillar foodplants. The cutting of eastern forests and spread of agriculture have created many more open fields, so the range of these species as well as their abundance have expanded following human settlement. These butterflies are sensitive to their habitat, however; a study in Iowa showed that diverse

vegetation along road edges supports more of them than road edges with fewer plant species. They fly through open fields or thinly wooded areas, but not forests, and their abundance declines as their open habitat is broken up into fragments.

One might expect the scientific name of Pearl Crescents to refer to the light colored crescent-shaped spot, just like the English name, but that's not the case, and the meaning of the scientific name is puzzling. Harry Zirlin, who regularly entertains the readers of this magazine with his "Taxonomists Just Wanna Have Fun" column, reported that the generic



The eggs hatch and the caterpillars cluster. Oct 3, 2002. Somerset Co., NJ.

name *Phyciodes* is closest to a Greek word meaning “covered with seaweed” (*American Butterflies* 12(4):36-40, Winter 2004). The only sense I can make of that is to call it a description of the network of fine brown lines on the underwings. Another source suggests that the name of the genus is from *phycis*, a fish that could change its color seasonally. We’ll come back to the different seasonal forms of Pearl Crescents in a moment. The species name *tharos* may be more easily understandable if it comes from the Greek *theros* for “summer,” but the source of the name is uncertain.

Pearl vs Northern Crescents

Although Pearl Crescents are widespread and pretty well known, confusion remains about these cute little butterflies! Most current field guides distinguish two species: Pearl Crescent, *Phyciodes tharos*, and Northern Crescent, *Phyciodes selenis* (or *coccyta* or *pascoensis* or *type B*, depending on which source you read). But when you see one of these butterflies flying over a field, it’s hard to distinguish them, and that’s because of the lack of a clear difference. The story behind this confusion reveals a lot about the complexity of nature.

Two different forms of Pearl Crescents were described by biologist Charles Oliver nearly 30 years ago. Supposedly, Pearl Crescents (his type A) are found from southern New England over to Michigan and southward, with black antennal clubs in males and several generations per year; in contrast, Northern Crescents (his type B) occur from that same geographic line northward, with antennal clubs in males being both orange and black, a single generation per year, and slightly larger body size. It's nearly impossible to distinguish the females of these two groups. The differences are small and variation is high, however, so the differences we see could be due simply to the differences in northern and southern environments, rather than to genetic differences. The two types are more separable in some geographic areas (Oliver said that is true in Pennsylvania, for example) than in others. Given their similar appearance, the Pearl and Northern Crescents have been confused for a long time; thus, many old records are unclear because we don't know which form the records refer to.

So how should we think about these two complex and confusing forms? It was astonishing to me to find that the very first published description of Pearl Crescents, from Drury in 1770, mentioned the high amount of variation: "In short, nature forms such a variety of this species, that it is difficult to set bounds, or to know all that belong to it." Recently, Bob Pyle in *The Butterflies of Cascadia* wrote "In naming the species after Cocytus, the River of Lamentation in the Underworld [one of five rivers that encircle Hades], Cramer seems to anticipate the woe in store for future students of crescent-spot taxonomy." Yep.

Two biologists have recently suggested that Pearl Crescents and Northern Crescents show only partial reproductive isolation and should be considered subspecies that differ only a little in size, range, and flight time. That conclusion seems the best for now, though molecular data shows there to be some limited differentiation.

In addition to Pearl and Northern Crescents, there are also the local and much less common Tawny Crescents in the East, the more distinguishable Field Crescents in the West, and the distinct Phaon Crescents in the South. All these species are similar in appearance. What are the genetic relationships among crescents? Molecular studies by biologist Niklas Wahlberg and his collaborators have shown how similar Pearl and Northern Crescents are to each other and both are to Tawny and Field Crescents. The southern Phaon Crescent looks similar but doesn't use asters as caterpillar foodplants. These species are all grouped together as the *tharos* group, named after the species name of the Pearl Crescent. But genetic studies give only half the story; the differences among these butterflies in the field indicates that ecological differences are also critical in our recognition of the different species.

Polyphenism

There's another source of variable appearance, too; Pearl Crescents that emerge in the spring look different from those that emerge in the summer. Temperature and day length are environmental cues that alter the expression of some genes, leading to the production of darker forms in springtime and lighter forms in the summer. Dark colors absorb more solar energy, so adults emerging in the cooler temperatures of spring benefit from the sun's warmth if they develop a darker pattern. The more strongly patterned spring seasonal form of Pearl Crescents has been named as "marcia" and the lighter patterned summer form as "morpheus." These two forms have been

*Opposite page: Pearl
Crescent caterpillars
enjoying a small white aster.
Oct 3, 2002. Somerset Co., N.J.*



recognized since the 1860s, with the difference being most noticeable on the underside of the hindwings. Experiments have shown that the seasonal forms of Pearl Crescents depend more on day length than on temperature.

The presence of differing spring and summer forms, a phenomenon called seasonal polyphenism, is known for a number of other butterflies, too, such as the Mustard White, which is also darker in the spring. The same thermal effect leads butterflies from cold arctic and alpine habitats, such as Labrador and Mead's Sulphurs, to have a higher density of dark scales than do sulphurs from warmer climates. These examples all point to the importance of temperature control in butterflies; being small insects, they must warm up to fly yet not suffer over-heating.

Black veins on an extensive orange surface enables the butterflies to gain heat while basking, but in addition to coloration, Pearl Crescents can regulate their body temperature behaviorally. They move to locations where they can balance the heat load, for example, by seeking out sites lower in the vegetation of a field where light is dappled.

Plant Relationships

Pearl and Northern Crescents lay their eggs on several different species of asters. My rearing records indicate that Pearl Crescents prefer New England and lance-leaved asters (*A. novae-angliae* and *A. lanceolatus*), but that they'll readily use crooked-stem aster (*A. prenanthoides*) as well. Published foodplants records for Pearl Crescents include a long list of scientific names: *Aster ciliolatus*, *ericoides*, *laevis*, *lanceolatus*, *novae-angliae*, *oolentangiensis*, *pilosus*, *prealtus*, *texanus*.

It's an indicator of evolutionary conservatism that all closely related crescents are also restricted to laying their eggs on plants in the genus *Aster*. Because Phaon Crescent is an exception, perhaps it's not as closely related. I've tried to feed Pearl Crescents other aster species as well. They don't like flat-topped aster (*A. umbellatus*) at all; it has a distinctive chemical that appeals



A Pearl Crescent chrysalis.
Oct. 7 2002. Somerset Co., NJ.

to Harris' Checkerspot (*American Butterflies* 10(2):18-25, Summer 2002) but repels Pearl Crescents.

The chemistry of the plants is crucial to the relationships between butterflies and plants. It's fair to say that all plants have at least a few unpalatable chemicals of some kind that reduce the extent to which herbivorous animals feed on them. Asters are known for a group of chemicals with 15 carbon atoms in each molecule (compounds known as sesquiterpenes), and with my organic chemistry colleague Robin Kinnel, we've found that all the asters used by Pearl Crescents contain the sesquiterpene chemical germacrene D. We haven't been able to find if this chemical induces females to lay their eggs, but we have shown that caterpillars are enticed to feed on artificial food to which



Here's looking at you!

Nov. 11 2003. Somerset Co., NJ.

we've added germacrene D. On the other hand, a different sesquiterpene, known as atractylon, is abundant in flat-topped aster, and this chemical is so highly repellent to Pearl Crescent caterpillars that they won't eat leaves with atractylon or artificial food with atractylon. As with other butterflies, female crescents have sensory receptors on their feet (tarsi) that enable them to taste the plants on which they alight and thus be choosy about where they lay their eggs.

Adult Pearl and Northern Crescents are avid nectar feeders, and, being small in size, they visit smaller flowers than some of our other field butterflies and like flowers with flattened tops. As is typical for butterflies, they are far less fussy about the plants from which they obtain nectar than they are about where they lay their eggs. In one long-term

study, adults were recorded feeding from 56 different plant species, including milkweeds, coneflower, and asters. When taking in nectar, the butterflies often pump their wings. One early source (Denton, 1900) stated that they "delight in the blossoms of the low plants," and I find that description pretty apt.

Reproduction

Pearl Crescents have multiple generations per year. In fields near my home in upstate New York, the first brood emerges in mid to late May and flies until the middle of June. The second brood appears at the end of June, and from that point on, these cute little butterflies are around continuously until early October, with the second and third broods blending in together. In Florida multiple generations are on the wing year round.

Males patrol for females, so most of the adults seen in a field are males, either flying, basking with open wings, or puddling on moist soil. Females are more often nestled in the vegetation, basking or laying eggs. Most mating and egg-laying takes place from late morning to early afternoon. The best conditions to find them are sunny days with moderate temperatures, from 10:30 to just after lunchtime.

Laying eggs in clusters rather than singly saves females time in finding the right plants, and the time savings is important when foodplants are distributed sparsely or when predators are attracted to flying adults. Females fly and crawl through the low vegetation when searching for a place to lay their eggs. If you watch a female fluttering over the vegetation of an open field on a bright sunny day, you'll see her land on plant after plant, basking with her wings open and walking a little on each leaf. As she walks, she recognizes plants with the right chemistry for egg-laying, and when ready to lay, she flips to the underside of the leaf and deposits a batch of eggs. Once settled, a female holds on to the edge or underside of the leaf and curls her abdomen. It takes her about 20 minutes to lay a mass of eggs.

The rate of egg-laying in Pearl Crescents is related to their small size. My students and I have raised many caterpillars and butterflies over the years and have kept track of the number of eggs in each egg mass. On average, a fresh, large female usually lays a first mass of nearly 100 eggs, but initial egg masses may be even larger (the largest we've recorded was 189). In contrast, we've measured 530 eggs in a single egg mass of the larger Baltimore Checkerspot. A female Pearl or Northern Crescent keeps laying as long as she is alive, usually every other day and no more than once per day, until she is quite old, worn, and thin.

Successive egg masses become smaller and smaller, mostly because a female can't replace all the protein she had accumulated when feeding as a caterpillar. Although nectar may contain some amino acids, which are

components of proteins, adult feeding on nectar provides little replacement protein. As she exhausts her protein supply, her egg production declines. The rate of decline is such that, after initial masses of about 95 eggs, those from 5-day-old females average 70 eggs per mass, and those from 10-day-old females average only 55 eggs.

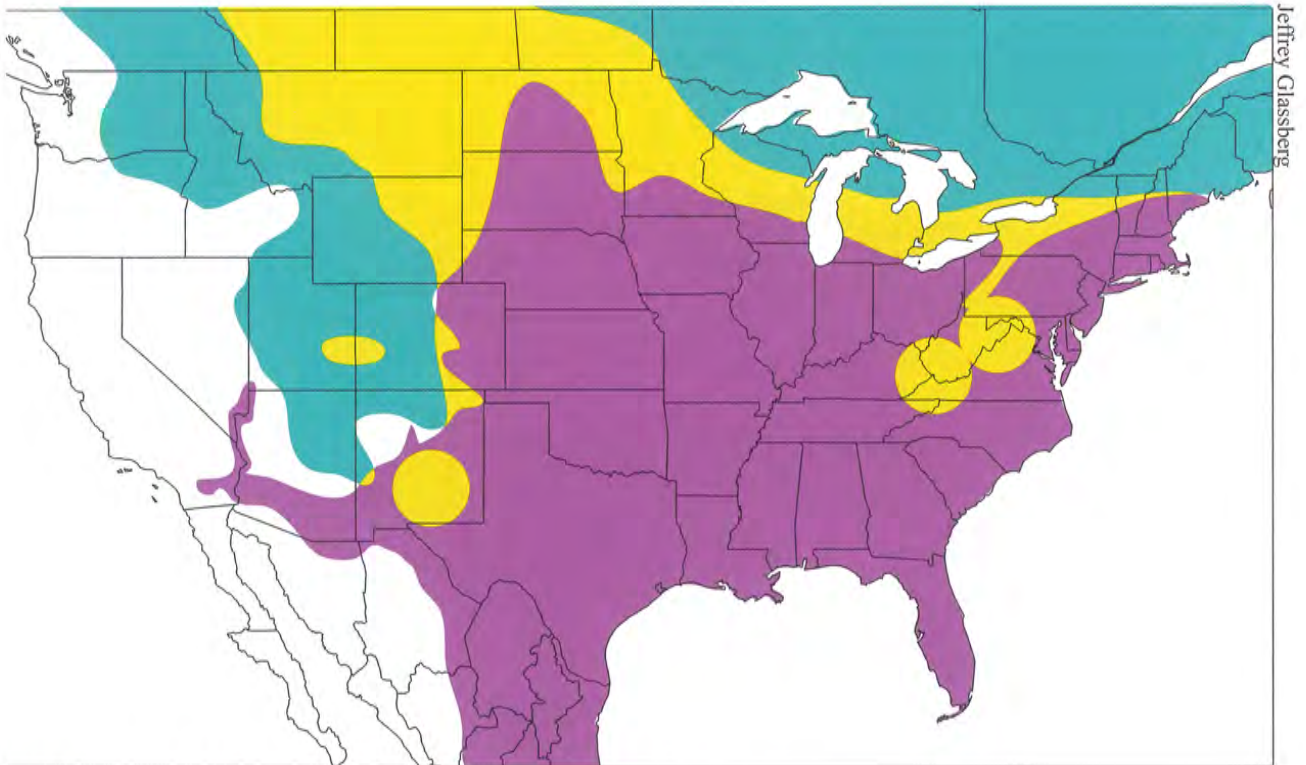
One of our females, for example, laid an egg mass every day for six consecutive days, with the first having 129 eggs and the last one 35 eggs. Egg size also declines with female age. With this same female, the eggs from her first mass averaged 60 mg each, while those from the last egg mass averaged only 50 mg.

The eggs are light green in color and blend in well with the leaf they're on. The camouflage of the eggs suggests that they're not chemically protected against predators. This story is different from that of other cluster layers, such as Baltimore Checkerspots and Gillett's and Harris' Checkerspots, whose eggs are warningly colored (they turn reddish brown) and contain toxins derived from their host plants.

Pearl Crescent eggs hatch in about 5 days. The young caterpillars remain together to feed when small, providing group defense against parasitic wasps. And though they don't spin larval webs, they may benefit from producing silk trails for feeding. The first feeding of the tiny caterpillars is on the outer epidermal layers of the leaves and only later, when larger, do they eat the entire leaf tissue.

In the Field

Look for Pearl or Northern Crescents in any open field or meadow; chances are some asters grow there. And remember to look down! Because the butterflies are small, you might overlook them at first, but as soon as you develop an image of what to look for, you'll start finding a few. Then see if you can recognize the different flight patterns that are characteristic of males and females, and if it's a sunny late morning, you might find a female laying a batch of eggs on the underside of a leaf. If so, count yourself lucky. You have just



Range of Pearl and Northern Crescents

- Range where Northern Crescents are found.
- Range where Pearl Crescents are found.
- Range where both Northern Crescents and Pearl Crescents are found.

found the first of more of these common and cute little butterflies.

Side Note

Most everyone recognizes the benefits of electronic communication, including its speed and general availability. Another benefit is the accessibility of a tremendous amount of information, and that's increasing rapidly, too – not just new information but old as well. Important published works from previous centuries are being digitally scanned, by Google and others, and a number of these books are now available electronically. In writing this article, I was able to view electronic copies of the following wonderfully informative classic works on butterflies.

Drury, D. 1770. *Illustrations of Natural History. Wherein are exhibited Upwards of Two Hundred and Forty Figures of Exotic Insects, According to their different Genera.* Printed by B. White, London.

Edwards, W.H. 1872. *The Butterflies of North America.* American Entomological Society, Philadelphia. (only part is available on-line).

Scudder, S.H. 1889. *The Butterflies of the Eastern United States and Canada, with special reference to New England.* 3 vols. printed by W.H. Wheeler, Cambridge, MA.